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K/TSO-28
Rev. 3

UF_6 CYLINDER PROJECT
ENGINEERING DEVELOPMENT PLAN

ENRICHMENT FACILITIES MANAGEMENT

JULY 1998

Prepared by
Enrichment Facilities Management
East Tennessee Technology Park
Oak Ridge, Tennessee 37831-7239
Managed by
Bechtel Jacobs Company LLC
for the
U. S. DEPARTMENT OF ENERGY
under contract DE-AC05-98OR22700

K/TSO-28, Rev. 3
UF_6 Cylinder Project Engineering Development Plan

APPROVALS

M. S. Taylor
Three-Site Project Manager

7/29/98
Date

S. J. Pawel
Three-Site Technical Manager

7/28/98
Date

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LIST OF FIGURES

ACRONYMS

ASME	American Society of Mechanical Engineers
DNFSB	Defense Nuclear Facilities Safety board
DOE	Department of Energy
DUF_6	depleted uranium hexafluoride
EDP	Engineering Development Plan
ES&H	Environmental Safety and Health
LMES	Lockheed Martin Energy Systems, Inc.
NE-1	Office of Nuclear Energy-DOE
NE-40	Office of Facilities-DOE
ORO	Oak Ridge Operations
PGDP	Paducah Gaseous Diffusion Plant
PORTS	Portsmouth Gaseous Diffusion Plant
PMP	Project Management Plan
SEMP	Systems Engineering Management Plan
SRD	System Requirements Document
UF_6	uranium hexafluoride
WBS	work breakdown structure
WCS	work control structure
UCLIM	UF_6 Cylinder Location, Inspection, and Maintenance
USEC	United States Enrichment Corporation

EXECUTIVE SUMMARY

The Department of Energy manages an inventory of uranium hexafluoride through the Uranium Hexafluoride Cylinder Project. The UF_6 Cylinder Project Engineering Development Plan is one of four key Systems Engineering documents used by Bechtel Jacobs Company LLC to manage the storage of uranium hexafluoride in cylinders. The purpose of Engineering Development is to enable the Project to improve the system's technical basis and effectiveness with respect to meeting requirements. The Engineering Development Plan is the management tool that describes the process of identifying tracking, reporting, and verifying development activities.

1. INTRODUCTION

1.1 BACKGROUND

The Department of Energy (DOE) owns an inventory of uranium hexafluoride (UF_6) nominally less than 5% enrichment. This inventory is managed by the UF_6 Cylinder Project. The bulk of the DOE inventory is 560,000 metric tons of depleted UF_6 (DUF_6) produced by the gaseous diffusion plant enrichment process while the plants were operated by DOE and its predecessors. The balance of the inventory is normal assay and low-enriched assay UF_6 contained in cylinders.

The inventory is stored as a crystalline solid principally under vacuum. The DUF_6 is stored primarily in 48-inch-diameter steel cylinders with capacities of 10 or 14 tons. Typical cylinders are 5/16-inch-thick pressure vessels that were designed and manufactured to the American Society of Mechanical Engineers (ASME) code.[1] The cylinders are maintained at three sites: the Paducah Gaseous Diffusion Plant (PGDP), in Paducah, Kentucky; the Portsmouth Gaseous Diffusion Plant (PORTS), in Piketon, Ohio; and the East Tennessee Technology Park (formerly known as the K-25 Site), in Oak Ridge, Tennessee. The inventory of cylinders containing DUF_6 is distributed at the three sites as follows: 28,400 cylinders at PGDP; 13,400 cylinders at PORTS; and 4,700 cylinders at the East Tennessee Technology Park.

After significant inventory of DUF_6 was produced from the enrichment process, outdoor storage facilities evolved independently at the sites. Cylinder yards were constructed of either concrete or compacted gravel, and cylinders were stacked in two-tiered rows on wooden or concrete saddles. The handling equipment used to stack these cylinders in double-tiered rows has also evolved, from mobile cranes to specially designed tractors that grasp and lift the cylinders with hydraulically actuated tines.

Until 1990, surveillance of the DUF_6 consisted of an annual nuclear materials inventory of the cylinders. The East Tennessee Technology Park cylinder yards were surveyed in May 1990 to provide input for planning long-term corrosion monitoring of cylinders. In the May 1990 survey, cylinder valves with corrosion and evidence of potential leakage were discovered. A June 1990 survey of cylinder valves at PORTS revealed two cylinders with breached side walls. Investigation of these cylinder breaches determined that the causes were mechanical tears caused by impact from the lifting lugs of adjacent cylinders.[2] Subsequent inspections of stored DUF_6 cylinders revealed four breached cylinders at the East Tennessee Technology Park. Two of these breaches were attributed to handling damage, and two were most likely initiated by external corrosion resulting from substandard storage conditions.[3] Another breached cylinder resulting from handling damage was discovered at PGDP.

The risk to personnel health and safety, and the potential environmental impact, posed by these cylinder breaches and valve leaks has been low, by nature of the system. The UF_6 inventory is stored as a solid. Reaction deposits formed when UF_6 is exposed to the atmosphere in the presence of mild steel have a self-sealing nature. The bulk of the inventory is depleted in the fissionable isotope of the UF_6 such that the hazard is mostly chemotoxic, not radiological. These factors contribute to

the low risk incurred from these and potential additional failures. This low risk was confirmed by analysis of the air and soil samples collected near the breaches at PORTS and by subsequent weighing of the cylinders. Although the risk posed by these breaches is low, the existence of breached cylinders heightened the importance of a comprehensive, long-term three-site cylinder management program. Consequently, in 1992, a cylinder integrity management plan was developed to address concerns within the storage yards and to establish the initial premise of the Project today.[4]

On May 5, 1995, the Defense Nuclear Facilities Safety Board (DNFSB) issued to DOE a recommendation regarding the storage of depleted UF_6 in cylinders.[5] The recommendations are summarized as follows:

- Start an early program to renew the protective coating of cylinders containing the tails from the historical production of enriched uranium.
- Explore the possibility of additional measures to protect these cylinders from the damaging effects of exposure to the elements, as well as any additional handling that may be called for.
- Institute a study to determine whether a more suitable chemical form should be selected for long-term storage of the depleted uranium.

On June 29, 1995, DOE accepted Recommendation 95-1[5] and emphasized five focus areas for DOE response:

- removing cylinders from ground contact and keeping cylinders from further ground contact;
- relocating all cylinders into adequate inspection configuration;
- repainting cylinders as needed to avoid excessive corrosion;
- updating handling and inspection procedures and site-specific Safety Analysis Reports (SARs); and
- completing an ongoing study that will include an analysis of alternative chemical forms for the material.

On October 16, 1995, DOE submitted an Implementation Plan[6] that incorporated completed and near-term activities in accordance with these five focus areas. The Implementation Plan[6] also committed to managing the UF_6 Cylinder Project using a Systems Engineering approach. The approach was developed concurrent with field response activities and was enhanced through an open dialogue among DNFSB staff and personnel from DOE and Lockheed Martin Energy Systems, Inc. (LMES). The Implementation Plan[6] specifies the following interim and final deliverables and defines their respective content to establish an operative Systems Engineering process for the continued improvement of depleted UF_6 management through the UF_6 Cylinder Project. The deliverables are:

- System Requirements Document (SRD);[7]
- System Engineering Management Plan (SEMP);[8]
- Engineering Development Plan (EDP);
- UF_6 Cylinder Project Management Plan (PMP);[9] and
- Approved Safety Analysis Reports.[10, 11, 12]

1.2 PURPOSE

The purpose of the EDP is to enable the Project to improve the system's technical basis and effectiveness with respect to meeting requirements. The EDP is the management tool that describes the process of identifying, tracking, reporting, and verifying development activities. These development activities are selected by prioritizing activities contained in Appendix B of the SEMP. The EDP also documents the process used to manage development activity progress, cost, and schedule prior to field deployment. This management process is consistent with the PMP and ensures proper integration and sequencing with all Project activities. Finally, the EDP provides a list of specific known development activities and their relationship to current system and technical requirements. The EDP then serves as a baseline plan to control development efforts in the Project. This baseline is used by Project Managers, the Technical Manager, and Lead Developer(s) and is reviewed at least annually.

The EDP is a component of the Systems Engineering approach adopted for successful planning and management of the three-site UF_6 Cylinder Project. This approach was initiated by the development of the system requirements and issuance of the SRD. The SEMP specifies the methods for planning and controlling actions within the Project. Figure 1.1 depicts the Systems Engineering approach for the UF_6 Cylinder Project.

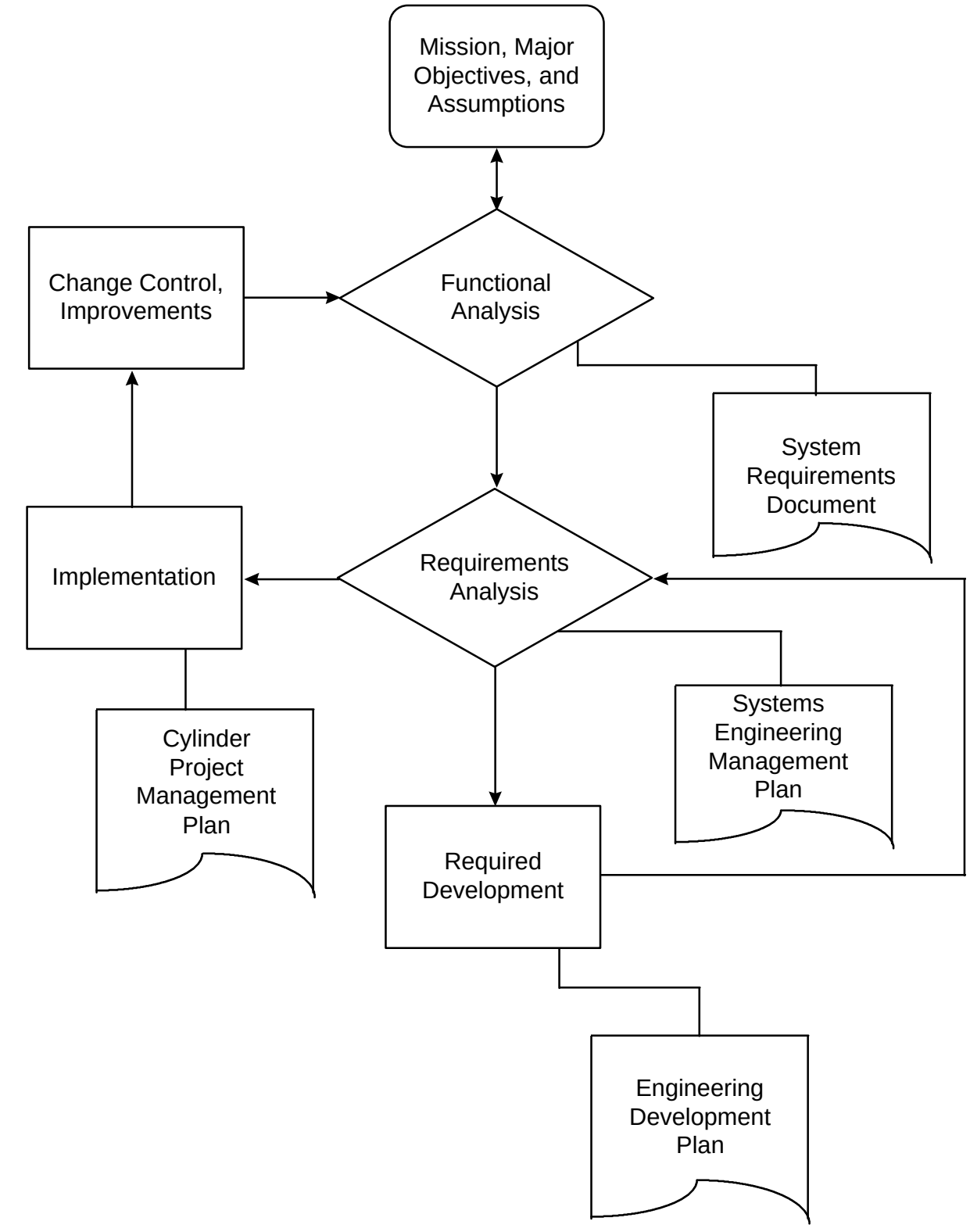


Fig. 1.1. Systems Engineering approach.

1.3 SCOPE

The EDP documents the UF_6 Cylinder Project management process for identifying, tracking, reporting, and verifying system development activities. The purpose of the EDP is to enable the Project to improve the system's technical basis and effectiveness with respect to meeting requirements. Current and future development activities are defined and authorized using the EDP process. Additional development activities are defined at least on an annual basis for inclusion in the PMP.

Required development activities are identified in the SEMP-defined requirements analysis. The analysis determines activities necessary to fulfill the requirements within the SRD. Activities that can be implemented immediately are managed through the PMP. Activities that require additional development prior to implementation are managed through the EDP. Proposed development activities, independent of system requirements and the SEMP requirements analysis, are documented and then analyzed against Project needs and priorities as part of the EDP process.

The EDP is a sub-plan of the PMP. The PMP ensures development activities are integrated and scheduled with Project needs and priorities. The Project work control structure (WCS) is specified and controlled in the PMP. Development activities will have, as necessary, detailed development plans and documentation.

1.4 DEVELOPMENT RATIONALE

The need for development activities can be identified through a variety of processes . These include:

- development identified from the requirements analysis as necessary to satisfy system or technical requirements;
- development to clarify the technical basis where needed before changes to the configuration are implemented (e.g., safety, risk-related);
- development to optimize the configuration in the interest of reducing costs, risks, or time; and
- development in support of resolving a deficiency identified internally or externally through audits, assessments, or reviews.

Based on the above rationale, development activities that meet and address the Cylinder Project major objectives have been identified in the SEMP. These same criteria can be used to validate new development activities arising from new requirements or information. The work breakdown structure (WBS) is used to associate development activities with the most applicable part of the system or Project.

1.5 EDP INTEGRATION AND INTERFACE

Once development activities are completed, the development findings are subjected to the SEMP requirements analysis for disposition (i.e., implementation, termination, further development). For implementation of development findings, these findings must be integrated with other system activities, including those in operations, administration, and possibly with other development activities. The system interfaces and method of integration are established in the planning stages of development.

The tool for ensuring integration of a development action with the rest of the system is verification. Specifically, verification ensures that the development task is focused on satisfying system and technical requirements. There are two verification steps in the EDP management process: scope verification (occurs prior to initiating the proposed work) and results verification (occurs at hold points or the end of the work).

The tool for managing interfaces of a particular development activity with other system activities is the WBS. The WBS identifies related elements to facilitate integration of activities. For the development portion of the WBS, this is accomplished by relating the development activities to other branches of the WBS.

2. DEVELOPMENT PHASES

The EDP development process is divided into distinct sequential steps. The development process provides the ability to control development as the need is verified, specified, then integrated into the Project as a development activity. Documentation of all phases of development includes:

- verification of activity proposal against known Project requirements, priorities, and schedules;
- monitoring of activity performance, cost, and schedule; and
- verification of final development results against identified SEMP actions.

To control the development within the Project a WCS has been established and defined in the SEMP. An integral component of the WCS is the WBS for the Project which is provided in the PMP.

For evaluation, approval, and tracking of development activities, a WCS Form (Appendix A) is used. After this WCS Form is completed it becomes a static contract for the development activity. It specifies the scope and expected form of results. Once it has been approved for development, changes to the form/activity must be approved by the Technical Project Manager.

In practical application, the WCS Form is completed in phases, increasing in detail and definition from the proposal step to initiation of the development activity. The completed WCS Form is used as the work control document for the development activity and ensures activities are prioritized and scheduled appropriately. Instructions for completing the WCS form are in Appendix A. Completed WCS forms for the EDP activities are in Appendix B.

2.1 ACTIVITY PROPOSAL

The EDP process begins with the identification of potential activities needing further analysis and/or study to improve the system's technical basis with respect to meeting requirements. These activities are identified through:

- audits, reviews, and evaluations;
- feedback from field operations;
- cylinder yard walkdowns;
- development of procedures;
- new or modified system and technical requirements;
- technological breakthroughs; or
- new ideas on technical, financial, or Project management.

The first step in the process begins when the Technical Project Manager receives a request or proposal. The initial documentation (on the WCS Form) is completed to solicit Project resources and to request verification of Project needs relative to existing activities, including other development.

Activities proposed because of new information (e.g., audits, compliance issues) but not a requirements analysis will likely generate a technical or system requirement reference and subsequent requirement analysis. A rigorous scope verification is still required to ensure integration with other Project activities, components, systems, and requirements. Ongoing and existing activities will be documented initially as proposed activities until requirements and scope are formally verified. A proposed activity resulting from a requirements analysis will have the appropriate scope developed. The proposal step then documents the activity as development, with an appropriate WBS element assigned in subsequent steps of this process. (Refer to Fig. 2.1 for the Development Process.)

2.2 SCOPE VERIFICATION

The scope verification phase will (1) determine if the proposed work plan is properly related to actions in Appendix B of the SEMP, (2) evaluate if and how the proposed work plan is integrated with other elements of the system (development and implementation such as interfacing components and operations), and (3) establish a results verification statement and method.

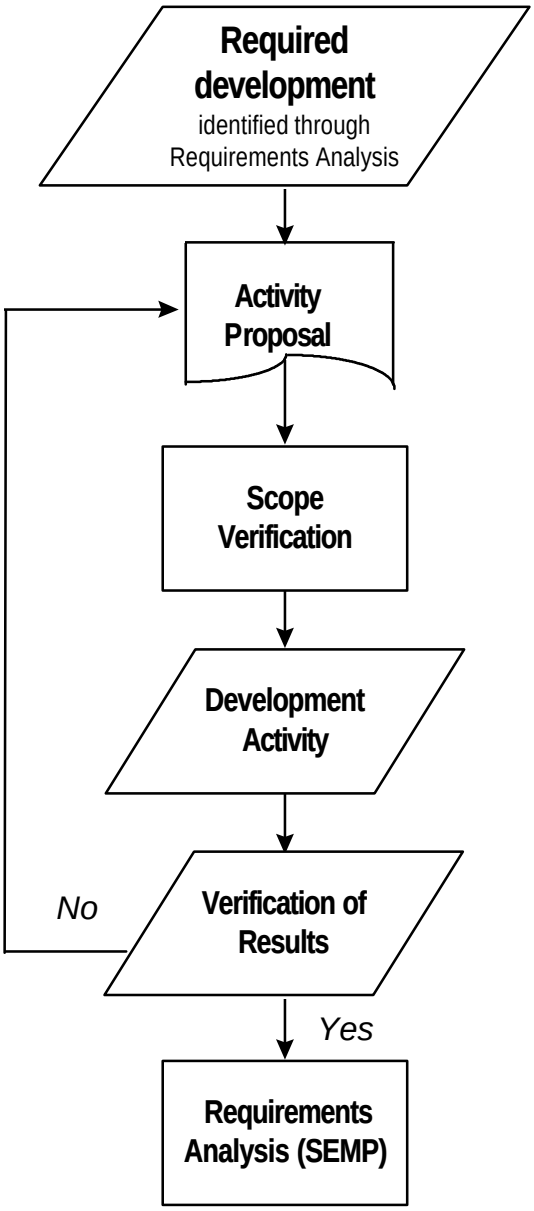
The scope verification phase may be repeated if, in the course of the development, circumstances necessitate the development plan be revised in scope. Circumstances may include the revision of a requirement, the integration of the new development activity, or unexpected interim results of the development activity.

The scope verification phase is the responsibility of the Technical Project Manager. The manager has full authority to complete this step and designate a Lead Developer. To facilitate completion of this step, the Technical Project Manager may, as necessary, call upon competent individuals or assemble ad hoc committees with appropriate knowledge or experience.

2.3 DEVELOPMENT ACTIVITY

The Development Activity portion of the EDP process indicates the actual accomplishment of the development work. Development proceeds as stated on the WCS Form and in specific detailed development plans. Development progress reporting allows development results to be communicated to the UF_6 Cylinder Project Manager for adjustments or verification in the integrated Project activities and priorities. It also allows for communication of new or changing Project requirements to the development activities. In circumstances where Project requirements have significant changes or interim development results (good or bad) are unexpected, the overall cylinder Project can be adjusted.

Additional interim reporting requirements could be imposed in cases of high risk development in terms of Project schedule, Project priorities, or cost limitations. Some development activities of short duration, small resource requirements, or low risk may not necessitate interim reporting. Interim reporting of development progress includes a technical, schedule, and budgetary comparison between actual and expected performance as specified on the WCS Form. Progress



CYLFIGSP.PPT

Fig. 2.1. Development process.

reporting allows the UF_6 Cylinder Project Manager to compare development activity progress relative to other Project activities in terms of cost, schedule, and development results.

2.4 RESULTS VERIFICATION

The results verification phase is completed after the development is finished. The results verification statement and method that were determined as part of the WCS Form specification before the development began (see Sect. 2.2) are used to complete this verification phase. The Technical Project Manager has responsibility and authority for the results verification phase. Results verification ensures that the product from development benefits progression toward fulfilling the scope within the identified SEMP actions. To facilitate completion of this phase he/she may call upon any competent individual or group of individuals knowledgeable of the system and development activities. The results verification may be integrated into the final steps of the development activity. However, the Technical Project Manager must approve the outcome of the results verification and make recommendations regarding implementation or additional development to the Cylinder Project Manager. All development reports and documents must be cataloged by Records Management and distributed to appropriate Project personnel.

3. ORGANIZATION, PLANNING, AND CONTROL

Management of DOE's depleted, natural, and enriched uranium is the responsibility of the Office of Nuclear Energy, Science and Technology (NE-1) and the Office of Facilities (NE-40). A program manager for depleted uranium resides under NE-40, Office of Gaseous Diffusion Plants Management. In accordance with the Energy Policy Act of 1992,[13] the Director of NE-1 is responsible for executing DOE's obligations with respect to materials not transferred to or generated by United States Enrichment Corporation (USEC). The Director of Nuclear Energy reports to the Secretary of Energy and is also responsible for ensuring execution of DOE's 1995 Implementation Plan[6] commitments to DNFSB. Overall Project policy, planning, and management (with particular emphasis on maintaining integration in support of ultimate material disposition) are carried out by the Director, a principal subordinate in NE-40, or a designee (the Assistant Manager for Enrichment Facilities).

3.1 THREE-SITE PROJECT MANAGER

Project Role: Manage, integrate, and guide the three-site UF_6 Cylinder Project.

Project Responsibilities:

- Lead and integrate the three-site Project level team in strategic planning, development, prioritization, and optimization.
- Develop and refine the Systems Engineering approach. As necessary, revise the SRD, SEMP, and PMP.
- Develop and maintain a roll-up of three-site Project cost and schedule baseline to meet overall Project goals and milestone. Each site is responsible for developing and, once agreed to, maintaining site-specific goals and milestones to meet overall project requirements.
- Ensure three-site consistency in requirements and implementation via the Systems Engineering process.
- Measure and verify Project performance within Bechtel Jacobs Company LLC and communicate performance to the EF Program Manager, and to Paducah and PORTS project managers, with particular emphasis on the commitments made to DNFSB.
- Provide adequate support for development of DOE's Programmatic Environmental Impact Statement by identifying issues and co-ordinating three-site resolution.
- Provide Project guidance for development and implementation activities.
- Communicate the safety, timeliness, and cost efficiency of the Project.

- Serve as the central point of contact for DOE-ORO and DOE-HQ project information requests. Coordinate with three-site personnel to ensure accurate information and good communication.
- Provide monthly status to the Bechtel Jacobs EF Program Manager and Paducah, PORTS, and ETTP project managers, on performance relative to budget, schedule, and milestones.
- Lead development and integration of three-site corrective actions to maintain consistency with Project mission and objectives.
- Coordinate and provide Bechtel Jacobs response to DNFSB Recommendation 95-1[5] in accordance with the DOE Implementation Plan[6] and as necessary.

Interfaces: The Three-Site UF_6 Cylinder Project Manager takes direction from EF Project Manager and interfaces with Paducah, PORTS, and ETTP project management; site cylinder personnel; site subject matter (environmental, safety and health) experts; Legal; and DOE-ORO personnel or their designees. Project Management also interfaces with DNFSB staff and DOE-Headquarters (HQ) personnel on specific issues with the awareness of DOE-ORO Assistant Manager for Enrichment Facilities or his designee (DOE Paducah Site Manager) and with the EF Program Manager.

3.2 THREE-SITE TECHNICAL PROJECT MANAGER

Project Role: Facilitate development of contingency requirements for the UF_6 Cylinder Project; participate in technical investigations and evaluations including procurement; represent technical aspects of the Project to DNFSB and DOE; and participate in implementation of the Systems Engineering process.

Project Responsibilities:

- Provide technical guidance on corrosion issues (includes painting and related specification and vendor evaluations, inspection requirements, results interpretation, and valve monitoring concerns) in coordination with site project personnel.
- Manage and integrate the engineering development process as described in the EDP and facilitate implementation of technical requirement (participate in development of procedures and Project plans) by coordinating with site, project personnel.
- Prepare and coordinate with the three-site project personnel the EDP Activity WCS Form and submit to the Three-site UF_6 Cylinder Project Manager and EF Project Engineer for approval.
- Perform development verification in accordance with the EDP; assign lead developer.
- Ensure documentation of technical information.
- Facilitate resolution of three-site technical issues.
- Stay abreast of the state-of-the-art corrosion management techniques.

- Participate in corrosion management conferences.
- Locate and assist in acquisition of technical expertise as deemed necessary.
- Compile status of development activities periodically.

Interfaces: The Technical Manager takes direction from the Three-site Project Manager and EF Project Engineer, has ongoing interfaces with the EF Program Manager and Paducah, PORTS, and ETTP project managers; Site Project personnel (for example engineering personnel involved in development); other Project technical personnel such as Inventory Modeling and Optimization Modeling; and Project/site field personnel, such as Operations and Maintenance personnel, and Quality Inspectors. The Technical Manager works with the designated Lead Developer to define the scope of development activities in accordance with the EDP.

3.3 LEAD DEVELOPER

The Lead Developer is responsible for working with the Technical Project Manager to define the scope of a development activity. Each development activity may have a different Lead Developer or one Lead Developer may be responsible for several development activities. Before the WCS Form is submitted to the UF_6 Cylinder Project Manager for prioritization, the Lead Developer must identify the work description, evaluation criteria, cost and schedule. The Lead Developer must coordinate with other Project functions to develop appropriate metrics for cost, schedule, and performance to ensure that the development expectations are met. The Lead Developer is responsible for carrying out the actual development work and reporting status to the Technical Project Manager per the milestones and schedules set in the WCS Form.

3.4 ADVISORY GROUPS

For all decision making within the development process, it is within the authority of the Technical Project Manager and/or the UF_6 Cylinder Project Manager to assemble a team of individuals with expertise in areas pertinent to Project activities. Typically, these teams would be ad hoc advisory groups dedicated to a evaluation of a specific decision, activity, or document. Examples might reasonably include peer reviews of reports or result interpretation, evaluation of implications of specific results or techniques, and efforts to facilitate sequencing of development activities.

4. SUMMARY AND STATUS OF DEVELOPMENT PLANS

With the exception of the following, all FY 1997 activities were completed as scheduled.

1. Analysis of corrosion on 30A cylinders - Activity postponed until FY 1998.
2. Stress analysis on new and degraded cylinders - Activity completed in FY 1998.
3. Evaluation of set-down for NCH 35s - Activity deleted in favor of evaluation of corrosion of O-channel cylinders.
4. ASTM Standards Development - Draft entitled "*A Packaging, Handling, and Storage Guide for Depleted Uranium Hexafloride,"* was completed and issued September 15, 1996. Presentation to ASTM subcommittee postponed indefinitely.
5. Functional analysis of cylinder project - Draft report K/TSO-43 was issued. Issuance of final report has been canceled.
6. Evaluate alternative methods to mitigate damage/corrosion to cylinders - Draft report was issued. Final report has been delayed due to budget cuts.

Table 4.1 summarizes currently funded FY1998 development activities. Table information includes deliverable description, SEMP Appendix B reference, development responsibility, scheduled completion dates, and estimated costs. As new requirements and technologies arise, they will be evaluated and integrated into the Project through the EDP process described in this document. Information from the individual development activities will provide sound, basic information for cylinder Project planning and budgeting. This EDP provides the framework to capture the development activities and associated costs that are key to continued successful maintenance of cylinder integrity and the UF_6 inventory.

These authorized task plans address particular aspects of referenced SEMP activity numbers. These tasks address prioritized SEMP activities within the constraints of sequencing of work and availability of funds.

The complete listing of development activities needed to support the Project is provided in Appendix C. These activities have been identified from the requirements analysis documented in the SEMP. Appendix C identifies the related WBS elements for each development activity, and provides a prioritization of activities based on needed improvements of the system as a whole. The prioritization of these activities is used to schedule and prioritize activities during the budget cycle.

Table 4.1. Development activity summary

Deliverable	SEMP App. B reference(s)	Lead developer	Scheduled completion date	Estimated cost
Title: Determine acceptance requirements for multiple cylinder functions				
- Draft report	2.1.2.2.5 2.2.1.2.3.1	S. J. Pawel	05/04/98	$25K
- Complete final report	4.1.2.2.1.1		06/01/98	$5K
Title: Disposition strategy for non-standard valve/plug replacement				
– Perform field investigation and develop options for analysis	2.1.5.2.4 2.3.3.2.3 4.1.2.2.3	G. M. Holland	6/01/98	$25K
– Draft plan for disposition strategy			6/15/98	$20K
– Issue final document/strategy report			8/01/98	$5K
Title: Develop maintenance plan to extend integrity of painted cylinders				
– Determine maintenance paint strategies and identify test cylinders for evaluation	2.1.1.2.5 2.1.1.2.7 4.1.2.2.4.1	G. M. Holland	4/15/98	$6K
– Apply paint to test cylinders and evaluate			9/1/98	$20K
– Issue final report			9/30/98	$4K

Table 4.1. Development activity summary (cont.d)

Deliverable	SEMP App. B reference(s)	Lead developer	Scheduled completion date	Estimated cost
Title: Evaluate Pilot Paint Performance at 2-year service life				
Perform 2 year evaluation and draft report	2.1.1.2.5	G. M. Holland	8/15/98	$18K
– Issue final report	2.1.1.2.7 4.1.2.2.4.1		9/30/98	$2K
Title: Update/Advance Corrosion Model				
Update corrosion model using FY 97 wall thickness data	1.2.2.2.1.2 4.2.2.3.1	B. F. Lyon	2/16/98	$40K
– Final report on model update and development support	4.2.2.3.1.1		3/6/98 (continuing as needed)	$20K
Title: Evaluate corrosion associated with minor flaws				
– Perform 1-year evaluation and draft report	2.1.1.2.5	G. M. Holland	8/15/98	$18K
– Issue final report	2.1.1.2.7 4.1.2.2.4.1		9/30/98	$2K
Title: Analysis of corrosion on 30A cylinders				
– Perform evaluation and draft report	1.2.2.2.1.2	D. G. Barreira	8/1/98	$21K
– Complete report	2.1.3.1 4.1.2.2 4.1.2.2.4 4.2.1.2		9/1/98	$3K

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2. E. J. Barber et al., *Investigation of Breached Depleted UF_6 Cylinders*, POEF-2086, ORNL/TM-11988, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., September 1991.

3. E. J. Barber, *Investigation of Breached Depleted UF_6 Cylinders at the K-25 Site*, K/ETO-155, ORNL/TM-12840, Martin Marietta Energy Systems, Inc., Oak Ridge Natl. Lab., October 1994.

4. M. S. Taylor et al., *Long-Term Storage Cylinder Integrity Management Plan*, K/ETO-114, Uranium Enrichment Organization, Martin Marietta Energy Systems, Inc., Oak Ridge, Tenn., September 1992.

5. *Recommendation 95-1 to the Secretary of Energy pursuant to 42 U.S.C. § 2286a(5)*, Atomic Energy Act of 1954, as amended, Defense Nuclear Facilities Safety Board, May 5, 1995.

6. H. R. O'Leary, U.S. Department of Energy, *Implementation Plan*, letter to J. T. Conway, Defense Nuclear Facilities Safety Board, October 16, 1995.

7. *UF_6 Cylinder Project System Requirements Document*, K/TSO-001, Rev. 4, Project Support Organization, Lockheed Martin Energy Systems, Inc., March 1998.

8. *UF_6 Cylinder Project Systems Engineering Management Plan*, K/TSO-017, Rev.2, Project Support Organization, Lockheed Martin Energy Systems, Inc., July 1997.

9. *UF_6 Cylinder Project Management Plan*, K/TSO-30, Rev. 2, Project Support Organization, Lockheed Martin Energy Systems, Inc., July 1997.

10. *Safety Analysis Report, Paducah Gaseous Diffusion Plant*, KY/EM-257, Lockheed Martin Energy Systems, Inc., March 30, 1998.

11. *Safety Analysis Report, Portsmouth Gaseous Diffusion Plant*, POEF-LMES-185, Lockheed Martin Energy Systems, Inc., March 30, 1998

12. *K-25 Site UF_6 Cylinder Storage Yards Final Safety Analysis Report*, K/D-SAR-29, Rev. 1, Lockheed Martin Energy Systems, Inc., May 1998.

13. Energy Policy Act of 1992, Public Law 102–486, U. S. Department of Energy (1992).

APPENDIX A
EDP Activity WCS Form and Instructions

The EDP activity WCS Form consolidates the EDP process information into a single form and procedure for the development process. Completion of the WCS information accomplishes a specification for the development activity results and a work control document to facilitate management of the development. Proper completion of the form allows traceability of the need for development back to the UF_6 Cylinder Project system and technical requirements as indicated in the SRD and SEMP.

Summary instructions for the WCS Form are provided. Additional information related to each phase of development is contained in the text of the EDP.

EDP Activity WCS Form

Side 1

TITLE: _____ **DATE:** _____

_____ **REV. #:** _____

SEMP ACTION

ITEM NUMBER(S): _____ **SEMP REV/DATE:**

_____

_____

_____ **ACTION NUMBER(S) APPROVED:**

_____

_____ _____

Cylinder Program Manager/Date

_____

WBS ELEMENT:

RELATED WBS ELEMENTS:

LEAD DEVELOPER:

BACKGROUND:

WORK DESCRIPTION:

VERIFICATION METHOD:

SCOPE VERIFIED: _____

Technical Program Manager/Date

TITLE: _____ (cont.)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date

TASK SPECIFICATIONS:

WCS APPROVED FOR DEVELOPMENT:

_____
Lead Developer/Date

_____
Technical Program Manager/Date

_____
Cylinder Program Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS: _____
Technical Program Manager/Date

SIGNIFICANT DOCUMENTS:

INSTRUCTIONS FOR EDP ACTIVITY WCS FORM

Title
A short descriptive title of the proposed activity. The title will be finalized as part of the scope verification process.

Date
Date on which this version of the WCS form is completed. For some activities, there will be multiple iterations of the form and the information it contains. The most current form will be tracked with the date and revision number.

Revision Number (Rev #)
The form revision number along with the current date indicates the most current revision of this form.

SEMP Action Item Numbers
One or more action items from Appendix D of the current revision of the Systems Engineering Management Plan (SEMP) will be indicated that require or support this development activity. These will be approved by the Cylinder Project Manager as part of the scope verification process.

SEMP Rev/Date
The current revision/date of the SEMP will be indicated for tracking purposes.

WBS Element
The Work Breakdown Structure (WBS) number assigned by the Cylinder Project Manager.

Related WBS Element
Related WBS elements refer to other Cylinder Project activities that have been identified by the Cylinder Project Manager (or as a result of the scope verification process) as those requiring coordination or integration with the current activity.

Lead Developer
In the early stages of development of this form, the Lead Developer can be the person preparing the WCS form or the person able to assume responsibility for the proposed work. Ultimately, the Technical Project Manager will designate the Lead Developer based on a combination of technical capability, availability, site/funding considerations, and input from the Cylinder Project Manager.

Background
In this section, relevant facts suggesting the need for the proposed work are conveyed. Examples of appropriate information include a description of the technical problem or its history, a description of prior development that was not complete or did not wholly satisfy the intent, or the ramifications of failure to provide timely information on a particular topic.

Work Description
In this section, the work activities that will address the needs identified in the Background section will be described. This information should include reference to any control documents (specifications, procedures, contracts, etc.) and should be sufficiently detailed to suggest the intended scope and the major tasks to be accomplished.

Verification Method
In this section, the criteria for evaluating the results generated by the activity are recorded. This information and the method(s) it describes represents the manner in which the Cylinder Project ensures that the task will satisfy system and technical requirements. Examples would include a peer review of the methods/results or a field trial to confirm a calculated result. If necessary, detailed descriptions can be appropriately referenced or attached.

Scope Verified
The Technical Project Manager is responsible for Scope Verification. To facilitate this phase, the Technical Project Manager may call upon competent individuals or ad hoc teams of individuals with appropriate knowledge or experience.

Task Plan
After the scope has been verified, this section is used to convey the sequence and schedule of activities to complete the development activity. Major steps or accomplishments should be indicated, along with the estimated cost to complete each step, a deliverable to track the accomplishment of each step, and a due date for the deliverable associated with each step. The information in this section should readily compare with the text in the Work Description section.

WCS Approved for Development
The WCS form is intended to be a development activity contract specifying boundaries, scope, and expected form of results. Upon signing this portion of the form, the Lead Developer assumes responsibility for the described activity and its completion (including interim deliverables) within the time and budget restraints indicated in the Task Plan section. Subsequently, signature by the Technical Project Manager indicates acceptance of the Task Plan as sufficient to generate the intended result and responsibility for timely verification. The Cylinder Project Manager then completes the signature list indicating commitment of the necessary funds and approval of the process to start the development activity. The development activity is approved for initiation when all three signature lines are complete.

Results Verified
The Technical Project Manager has responsibility for determining if the task plan has been completed in satisfactory fashion and the results verified back to the SEMP actions using the criteria indicated in the Verification Method section. Signature on this line indicates the development activity is complete.

Significant Documents
To expedite integration of the development activity results into appropriate Project activities or to initiate future development work, a list of documents generated by the completed activity will be compiled by the Technical Project Manager.

APPENDIX B
EDP Activity WCS Forms for Current Activities

WCS Forms for current Cylinder Project development activities are presented on the following pages. All current development activities have a WCS Form and are stated to be in the "Proposed" phase of the EDP process outlined in this document. As the EDP document and process is approved, these development activities will be conformed to the EDP process to verify scope and appropriate completion of the WCS. Completion of the WCS Form through the "Create WCS" phase of the EDP process will ensure proper documentation and control for the development activity.

EDP Activity WCS Form

Side 1

TITLE: Evaluate pilot paint performance at 2-year service life **DATE:** 02/98

REV. #: 2

SEMP ACTION ITEM NUMBER(S): 2.1.1.2.5

2.1.1.2.7

4.1.2.2.4.1

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:
M. S. Taylor (signature on file 3/09/98)

Cylinder Project Manager/Date

WBS ELEMENT:
RELATED WBS ELEMENTS:
LEAD DEVELOPER: G. M. Holland, Paducah (Kevil) Engineering)

BACKGROUND: The coating system selected for the Cylinder Pilot Paint effort at Paducah was selected through an evaluated bid process rather than specific data or experience indicating long term suitability of inorganic zinc n an SP-6 surface. While the evaluation team deemed this system the best of those offered (it also had the lowest cost per cylinder), the Cylinder Project has only limited experience with performance of this system on cylinders. Clearly, only actual field results define the performance of the contractor and the paint system applied. Feedback from periodic paint inspections, particularly those representing fairly short service life, contributes to improvements in future specifications for painting and paint selection and generates the experience and technical basis for determination of long term inspection frequency and maintenance requirements. The initial performance evaluation of the Pilot Paint effort documented performance and recommendations for improvement following about six months exposure. This follow-up evaluation is planned to represent the first two years of service for the Pilot Paint system.

WORK DESCRIPTION: The performance evaluation will consist primarily of a visual assessment (and photographic documentation) of paint condition on a representative number of cylinders (minimum 400) following approximately two-year exposure. The assessment will focus on weaknesses identified in the six month evaluation (accomplished in February 97 and published in April 97) and on the performance and aesthetics of any spots receiving touch-up maintenance (handling scuffs, holiday rust blooms, etc.). In addition, thickness of the zinc as a function of position (top, sides, near bottom) on randomly selected cylinders (at least 24 cylinders representing a range of painting dates) will be evaluated (and documented by reproducible location for future evaluations) for significant changes compared to the original 3-5 mil thickness specification.

VERIFICATION : The report documentation will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the draft report has passed a review of peers in the lead developer's organization, as well as review and comment by the NACE Inspector and the Technical Project Manager and/or the designees of same.

SCOPE VERIFIED: S. J. Pawel (signature on file,02/27/98)
Technical Project Manager/Date

TITLE: Evaluate pilot paint performance at 2-year service life (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Perform 2-year evaluation of paint system performance	$14K	letter of completion	07/01/98
draft report	$4K	peer-reviewed document	08/15/98
final document	$2K	distribution	09/30/98

TASK SPECIFICATIONS:

This task is supported by personnel familiar with cylinders and Project history of the painting process and paint evaluations. Other EDP activities associated with development of maintenance strategies and evaluation of other paint concepts may benefit from prompt, routine communication with the lead developer of this activity.

WCS APPROVED FOR DEVELOPMENT:

G. M. Holland (signature on file, 02/27/98)
Lead Developer/Date
S. J. Pawel (signature on file, 02/27/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 03/09/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Update/Advance Corrosion Model

DATE: 10/01/97
REV. #: 0

SEMP ACTION ITEM NUMBER(S): 1.2.2.2.1.2
4.2.2.3.1
4.2.2.3.1.1

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 1/9/98)
Cylinder Project Manager/Date

WBS ELEMENT: 1.3.2

RELATED WBS ELEMENTS:

LEAD DEVELOPER: B. F. Lyon, ORNL Risk Analysis Section

BACKGROUND: A cylinder corrosion model has been developed (the most recent version is ORNL/TM-13359) using ultrasonic wall thickness data primarily from P-scan campaigns on cylinder bodies. The model is statistically-based and predicts populations of cylinders with particular minimum wall thicknesses as a function of time in the storage yards. To date, about 2% of the total inventory of cylinders has been "sampled" for wall thickness. Additional cylinder wall thickness data collected in FY 97 includes P-scans of about 100 cylinder bodies and the initial campaign to collect wall thickness data in the head/skirt crevice (about 375 skirted cylinders). The cylinder corrosion model must be maintained and updated as new data is available as it forms the basis of painting, disposition, and future storage decisions.

WORK DESCRIPTION: This task will incorporate the wall thickness data collected in FY 97 into the cylinder corrosion mode. This will include an update of the present corrosion model based on measurements from cylinder bodies and will generate a similar (but perhaps preliminary model for corrosion in the head/skirt crevice of skirted cylinders. In addition, this task will also provide technical/statistics support on an as-needed basis for other Cylinder Project activities (for example, sampling of valves for evaluation of potential leaking, evaluation of paint performance, and support of information meetings/briefings as required).

VERIFICATION: The update of the corrosion model using the data collected in FY 97 will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the corrosion model update has passed a review of peers in the lead developer's organization, as well as review and comment by the Technical Project Manager and/or the designees of the same. Written correspondence in support of other Project activities will be subject to less formal review.

SCOPE VERIFIED: S. J. Pawel (signature on file,01/08/98)
Technical Project Manager/Date

TITLE: Update/Advance Corrosion Model (cont.)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Update corrosion model using FY 97 wall thickness data (bodies and head/skirt crevices)	$40K	peer-reviewed draft report	02/16/98
Final report on model update	$5K	distribution	03/06/98
Development support for other statistical characterization efforts	$15K	letter reports	as needed

TASK SPECIFICATIONS:

This task is supported via Memorandum of Understanding between the Cylinder Project and Lockheed Martin Energy Research (LMER). The LMER personnel will be knowledgeable and experienced in mathematical modeling and statistical sampling. In addition, the LMER personnel should be familiar with cylinder design and Project history.

WCS APPROVED FOR DEVELOPMENT:

B. F. Lyon (signature on file, 01/08/98)
Lead Developer/Date
S. J. Pawel (signature on file, 01/08/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 01/09/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Evaluate Corrosion Associated with Minor Paint Flaws

DATE: 10/01/97

REV. #: 1

SEMP ACTION ITEM NUMBER(S): 2.1.1.2.5; 2.1.1.2.7; 4.1.2.2.4.1

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 1/3098)

Cylinder Project Manager/Date

WBS ELEMENT: 1.3.2

RELATED WBS ELEMENTS:

LEAD DEVELOPER: G. M. Holland, Paducah (Kevil) Engineering)

BACKGROUND: In the six month performance evaluation of the Pilot Paint System (accomplished February 97 and published April 97), rust bloom in very small areas was detected on a number of cylinders. Specifically, the bottom of deep pits on the cylinder underside, particularly areas adjacent to stiffening rings, and areas immediately adjacent to the valves were found to be areas exhibiting small coating holidays. Two rows of cylinders in the C-745-S Yard containing a total of about 30 cylinders with these minor defects were identified in the evaluation but left intentionally unrepaired. Paint degradation around these minor holidays is to be examined after approximately 1 year of exposure to evaluate the urgency associated with repair/touch-up timing.

WORK DESCRIPTION: The cylinders with minor holidays left unrepaired will be revisited for a visual assessment (and photographic documentation) of the performance of the paint adjacent to the holiday. In particular, evidence of growth of the holiday, lifting or blistering of the zinc adjacent to the holiday, corrosion of the steel at/in the holiday, and thickness of the zinc in the immediate vicinity of the holiday are to be recorded such that further changes can be tracked as a function of time.

VERIFICATION: The report documentation will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the draft report has passed a review of peers in the lead developer's organization, as well as review and comment by the NACE Inspector and the Technical Project Manager and/or the designees of same.

SCOPE VERIFIED: S. J. Pawel (signature on file,01/14/98)

Technical Project Manager/Date

TITLE: Evaluate Corrosion Associated with Minor Paint Flaws Left Unrepaired (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Perform 1-year evaluation of holidays left unrepaired	$14K	letter of completion	07/01/98
Draft report	$4K	peer reviewed document	08/15/98
Final document	$2K	distribution	09/30/98

TASK SPECIFICATIONS:

This task is supported by personnel familiar with cylinders and Project history of the painting process and paint evaluations. Other EDP activities associated with development of maintenance strategies and evaluation of other paint concepts may benefit from prompt, routine communication with the lead developer of this activity.

WCS APPROVED FOR DEVELOPMENT:

G. M. Holland (signature on file, 01/27/98)
Lead Developer/Date
S. J. Pawel (signature on file, 01/14/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 01/30/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Analysis of Corrosion on 30A Cylinders **DATE:** 12/01/97

REV. #: 2

SEMP ACTION ITEM NUMBER(S): 1.2.2.2.1.2; 2.1.3.1; 4.1.2.2, 4.1.2.2.4, 4.2.1.2

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 1/30/98)

Cylinder Project Manager/Date

WBS ELEMENT: This activity will be funded on carry-over monies from the FY 97 EDP

RELATED WBS ELEMENTS:

LEAD DEVELOPER: D. G. Barreira, Paducah (Kevil) Engineering)

BACKGROUND: Stress calculations and field measurements of stress to define/defend the safety basis for current handling methods and procedures for 48" cylinders are currently being developed. Cylinder movement campaigns (supporting new yard construction, restacking for improved inspectability, and painting) are planned for the near future that will involve a number of 30A cylinders for which no comparable stress calculations or measurements exist. Potentially complicating any structural analysis is the fact that the 30A cylinders have experienced undetermined amounts of corrosion through years of exposure to the elements. In addition, less than ideal storage conditions (line contact with other cylinders or the yard surface) may have contributed to locally accelerated corrosion.

WORK DESCRIPTION: This task will assess the corrosion condition of representative 30A cylinders. The wall thickness evaluations will be performed on a minimum of sixteen 30A cylinders selected randomly within the limitations of accessibility and the movement campaign. The wall thickness evaluations will utilize hand-held ultrasonic probes to document the general wall thickness of the cylinder as well as the wall thickness in regions of potentially accelerated corrosion. The latter will be determined visually and are expected to be located primarily at/near positions of cylinder body contact with other cylinders or the yard surface, as well as near the 6 o'clock position of the concave cylinder heads. The primary deliverable for this investigation is a report documenting the measurement techniques, results for the individual cylinders and trends for the 30A cylinder population, and recommendations regarding the relative need for changes to the current handling/stacking practice to account for the observed corrosion.

VERIFICATION: The report documentation will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the draft report has passed a review of peers in the lead developer's organization, as well as the Technical Project Manager and/or the designees of same.

SCOPE VERIFIED: S. J. Pawel (signature on file,01/26/98)

Technical Project Manager/Date

TITLE: Analysis of Corrosion on 30A Cylinders (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Select measurement strategy and specific 30A cylinders for evaluation	$4K	task plan for approval	04/01/98
Perform wall thickness evaluation on a minimum of sixteen 30A cylinders	$12K	letter of completion	06/01/98
draft report on results and preliminary conclusions	$5K	peer-reviewed document	08/01/98
complete report	$3K	distribution	9/01/98

TASK SPECIFICATIONS:

This task is supported by personnel familiar with cylinders and Project history of ultrasonic wall thickness measurements. LMUS support personnel may be used as necessary to facilitate wall thickness measurements. The lead developer will prepare a measurement strategy consistent with the goals of this investigation and, in so far as possible, the current procedure for ultrasonic wall thickness measurements on 48" cylinders. Communication with the Project statistician and/or the Technical Manager regarding the sampling plan for cylinders to evaluate is required.

WCS APPROVED FOR DEVELOPMENT:

D. G. Barreira (signature on file, 01/28/98)
Lead Developer/Date
S. J. Pawel (signature on file, 01/26/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 01/30/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Determine acceptance requirements for multiple cylinder functions **DATE:** 03/31/98

REV. #: 0

SEMP ACTION ITEM NUMBER(S): 2.1.2.2.5; 2.2.1.2.3.1; 4.1.2.2.2

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 4/13/98)

Cylinder Project Manager/Date

WBS ELEMENT:

RELATED WBS ELEMENTS:

LEAD DEVELOPER: S. J. Pawel

BACKGROUND: Cylinder Project Management is obligated to interpret applicable national standards and flowdown these standards into project activities. For some project activities national standards are not applicable and acceptable cylinder conditions need to be established by the Project, particularly with surveillance and maintenance, and handling and stacking functions. In response to this need the Project has sponsored engineering development tasks to define particular aspects of cylinder performance associated with the four cylinder functions (surveillance and maintenance, handling and stacking, contents transfer, and off-side transport). The results of this development need to be distilled into a comprehensive cylinder acceptance report.

WORK DESCRIPTION: It is the objective of this task to relate existing technical reports and other project documentation into an internal set of acceptance requirements for each cylinder function. To accomplish this task, relevant information will be reviewed and interpreted with respect to each cylinder function. It is anticipated that this activity will also identify areas requiring further development to define necessary requirements and acceptance criteria.

The primary deliverable for this task is a report describing the "Project interpretation" of the acceptance requirements for each cylinder function. The report will include reference(s) to applicable documentation and will be reviewed prior to publication by representatives of each site.

VERIFICATION : The report documentation will be reviewed and accepted by the Cylinder Project Manager. This process will include documentation that the draft report has passed a review of peers in the Cylinder Project, including at least one technical representative.

SCOPE VERIFIED: M. S. Taylor (signature on file 4/13/98

TITLE: Determine acceptance requirements for multiple cylinder functions, Rev. 0 (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Review of relevant information (technical reports, existing guidance and specifications, etc.)	$15K	Outline of document	04/20/98
draft report	$10K	draft for review	05/04/98
Complete final report	$5K	distribution	06/01/98

TASK SPECIFICATIONS:

This task is to be performed by personnel familiar with Cylinder Project history and current needs. The Technical Manager for the Project will lead this development effort.

WCS APPROVED FOR DEVELOPMENT:

S. J. Pawel (signature on file 4/15/98)
Lead Developer/Date

S. J. Pawel (signature on file 4/15/98)
Technical Project Manager/Date

M. S. Taylor (signature on file 4/15/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Disposition strategy for non-standard valve/plug replacement **DATE:** 02/98

REV. #: 2

SEMP ACTION ITEM NUMBER(S): 2.1.5.2.4, 2.3.3.2.3, 4.1.2.2.3

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 3/09/98)

Cylinder Project Manager/Date

WBS ELEMENT:

RELATED WBS ELEMENTS:

LEAD DEVELOPER: G. M. Holland, Paducah (Kevil) Engineering)

BACKGROUND: There are a number of non-standard valves and plugs throughout the 30A cylinder population. Presently, there is no procedure or disposition strategy to address non-standard valves and plugs should damage/leaks be detected during inspection or if damage is incurred during handling/transport. Further, no replacement hardware is presently available.

Some priority is assigned to this investigation because cylinder movement campaigns (in support of new yard construction, restacking for better inspection, and painting) are planned for the near future that will involve a number of 30A cylinders.

WORK DESCRIPTION: Determine the number and types of non-standard valves and plugs across the three-site cylinder population. Documentation of this information shall include the numbers and model(s) of cylinders involved and the type of non-standard equipment involved (manufacturer, material, dimensions, location and method of attachment to the cylinder). A strategy for the disposition of the non-standard components in the event of unsatisfactory service (leak, requirements change) shall be developed through a requirements analysis (and/or cost/benefit analysis). Documentation of options considered, the requirements (or other) analysis, and the recommended disposition strategy in the event of unsatisfactory service is the primary deliverable of this effort. This effort will specifically include consideration of "smart plugs" (off-the-shelf varieties and/or those requiring engineering design).

VERIFICATION: The disposition strategy will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the draft strategy has passed a review of peers in the lead developer's organization, as well as review and comment by the Cylinder Yard managers, and the Technical Project Manager and/or the designees of same.

SCOPE VERIFIED: S. J. Pawel (signature on file,02/27/98)

Technical Project Manager/Date

TITLE: Disposition strategy for non-standard valve/plug replacement (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Field investigation to determine the number/types of non-standard valve/plug components at all three sites	$15K	letter of completion	05/15/98
Develop options for analysis (team meeting)	$10K	list of options for approval	06/01/98
draft plan for disposition strategy	$20K	peer-reviewed document	06/15/98
final document/strategy report	$5K	distribution	8/01/98

TASK SPECIFICATIONS:

This task is supported by personnel familiar with cylinders and Project history for valve/plug evaluations (use and operation, procurement history). This task may benefit from information exchange with other tasks and data collection for development projects associated with valve/plug management.

WCS APPROVED FOR DEVELOPMENT:

G. M. Holland (signature on file, 02/27/98)
Lead Developer/Date
S. J. Pawel (signature on file, 02/27/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 03/09/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

EDP Activity WCS Form

Side 1

TITLE: Develop maintenance plan to extend integrity of painted cylinders **DATE:** 02/98

REV. #: 2

SEMP ACTION ITEM NUMBER(S): 2.1.1.2.5; 2.1.1.2.7; 4.1.2.2.4.1

SEMP REV/DATE: Rev. 0/7-96

ACTION NUMBER(S) APPROVED:

M. S. Taylor (signature on file 3/09/98)

Cylinder Project Manager/Date

WBS ELEMENT:

RELATED WBS ELEMENTS:

LEAD DEVELOPER: G. M. Holland, Paducah (Kevil) Engineering)

BACKGROUND: There are about 14,000 cylinders at Portsmouth and Paducah Gaseous Diffusion Plants which have original paint in good condition or which have recently been repainted. In addition, a production painting program is in place that will repaint about 10,000 additional cylinders over the next five years. Periodic tough-up maintenance to prevent the initiation and spread of corrosion will be necessary to maximize the service life of the paint system.

WORK DESCRIPTION: Using consultation with the manufacturer(s) of the current paint systems(s) and/or industry experts, review of pertinent literature, and discussions with cylinder yard support personnel, a short list of potential maintenance strategies (including surface preparation requirements and the identity of an appropriate maintenance paint) will be developed. Subsequently, a group of test cylinders will be selected on which trials of the highest rated maintenance strategies can be initiated. This group of test cylinders may include, but is not limited to, some of the cylinders bearing paint holidays that were intentionally left unrepaired following the Pilot Painting operation.

This evaluation will include execution maintenance strategies as agreed upon with the Technical Manager as well as pre- and post-maintenance documentation of the cylinder/paint condition (photographs as appropriate). Each maintenance technique will be utilized on several different cylinders in different areas (e.g., areas frequently wet, such as bottoms near stiffening rings, and regions frequently dry, such as around valve bosses). The performance of the touched-up areas will be evaluated after 10-12 weeks (this investigation) and again in out years (new funding). The primary deliverable of this effort is a report summarizing the information collected on maintenance strategies and the results of the initial evaluation of the various maintenance methods and will include recommendations for future evaluations of the maintenance strategies.

VERIFICATION : The report documentation will be reviewed and accepted by the Technical Project Manager. This process will include documentation that the draft report has passed a review of peers in the lead developer's organization, as well as review and comment by the NACE Inspector and the Technical Project Manager and/or the designees of same.

SCOPE VERIFIED: S. J. Pawel (signature on file,02/27/98)

Technical Project Manager/Date

TITLE: Develop maintenance plan to extend integrity of painted cylinders (cont'd)

TASK PLAN

Task description	Approximate cost	Deliverable	Due date
Determine maintenance paint strategies and identify test cylinders for evaluation	$6K	task plan for approval	04/15/98
Apply maintenance paint to test cylinders	$10K	letter of completion	06/01/98
evaluate test cylinders draft report	$10K	peer-reviewed document	09/01/98
final report	$4K	distribution	9/30/98

TASK SPECIFICATIONS:

This task is supported by personnel familiar with cylinders and Project history of the painting process and paint evaluations. Other EDP activities associated with development of maintenance strategies and evaluation of other paint concepts may benefit from prompt, routine communication with the lead developer of this activity. In addition, the lead developer shall communicate with yard managers at all three sites to maintain awareness of any field trials or other activities potentially related to paint maintenance. As agreed upon with the Technical Manager, appropriate documentation of field activities at other sites shall be included in the documentation for this task.

WCS APPROVED FOR DEVELOPMENT:

G. M. Holland (signature on file, 02/27/98)
Lead Developer/Date
S. J. Pawel (signature on file, 02/27/98)
Technical Project Manager/Date
M.S. Taylor (signature on file, 03/09/98)
Cylinder Project Manager/Date

RESULTS VERIFIED TO SEMP ACTIONS:

Technical Project Manager/Date

SIGNIFICANT DOCUMENTS:

APPENDIX C
Correspondence of SEMP Needed Actions to EDP Activities
–SEMP "E" Needed Actions to EDP WBS Elements–

Actions listed in the SEMP Appendix B are presently divided into actions requiring further development (code letter E, for EDP) and those that are more closely related to an implementation activity (code letter P, for PMP). As the Project generates more information and/or the scope changes, it is expected that this assessment (E vs P) will be revisited periodically and updated as necessary. For the present, the SEMP requirements (items E from Appendix B) that require further development activity have been prioritized (1 is highest, 4 lowest) by a team lead by the Project Manager and consisting of the Technical Project Manager, the Project Operations Manager, and each of the Cylinder Yard Managers. Activities supporting the highest priority requirements are selected for funding when it is not possible to fund sufficient development to address all requirements that are not complete.

			SEMP "E" Needed Actions to EDP WBS Element		
WBS #	**SEMP #**	**Pri.**	**Action**	**Resp. Org.**	**(E)DP or (P)MP**
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.2.1.2.3.1	1	Define acceptable cylinder integrity, incorporating cylinder degradation concerns, for handling, processing, and transport.	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.1.1	1	Perform laboratory studies and other analyses to support the definition of cylinder integrity criteria.	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.1.2	1	Perform structural analysis in support of the developing functional acceptance criteria.	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.2	1	Define cylinder functional acceptance criteria based upon applicable industrial standards and cylinder performance objectives. [4.1.2.a, 4.1.2.b]	PS	E
1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.1.2.2.5	1	Determine cylinder inspection/acceptance requirements for transitioning cylinders from one function to another if one cylinder acceptance criteria is not adopted for all functions.	PE PS	E
1.1.2, 1.1.4, 1.3.2	2.1.2.2.4	1	Develop a structural feature inspection and maintenance plan to maintain compliance with this requirement, and integrate the plan with the program.	PI	E
1.1.2, 1.1.4, 1.3.2	2.1.5.2.4.1	1	Determine the necessary periodic surveillance and preventive maintenance of valves and plugs. [2.1.5.a, 2.1.5.b]	PE PS	E
1.1.2, 1.1.4, 1.3.2, 1.5.2	2.1.5.2.4	1	Develop a valve and plug management program to ensure that performance objectives are met. [2.1.5.a]	PE PI PS	E
1.1.2, 1.1.4, 1.3.2, 1.5.2	2.1.5.2.4.2	1	Determine methods and when valves and plugs should be repaired/replaced as corrective maintenance. [2.1.5.b]	PI PS	E
1.1.2.1, 1.1.4.3, 1.3.2	2.1.1.2.7	1	Determine the coating inspection and maintenance intent, method and frequency.	PS	E
1.1.3, 1.1.4, 1.1.5, 1.3.2, 1.4.1, 1.4.2	4.2.2.3.1.1	1	Project the number of non-compliant cylinders.	PE PS	E
1.1.4, 1.3.2	2.1.2.2.3	1	Identify and evaluate modifications to cylinder structural features that retain water to allow drainage.	PS	E
1.1.4.2 1.3.2	2.1.1.2.5	1	Test coating method.	PS	E
1.1.4.3, 1.3.2	2.1.2.1	1	Analyze options to reduce cylinder time of wetness caused by cylinder structural features.	PS	E
1.1.4.3, 1.3.2	2.1.5.2.4.3	1	Determine methods and frequencies for valve and plug surveillance and preventive maintenance. [2.1.5.a]	PI	E
1.1.4.4, 1.2.1, 1.3.2	2.2.1.2.1	1	Identify equipment performance objectives relative to handling, processing, and transport operations. [2.2.1.e]	PE	E
1.3.2	4.1.3.2.1	1	Identify, and grade for severity, factors that could degrade cylinder integrity [4.1.3.a].	PS	E
1.3.2, 1.4.1, 1.4.2	4.2.2.3.1	1	Forecast cylinder conditions using the parameters identified. [4.2.2.b]	PE PS	E
1.3.2, 1.4.2	1.2.2.2.1.2	1	Model corrosion to project cylinder integrity.	PS	E
1.3.2, 1.4.2	1.2.2.2.2	1	Define standards for when and how these risk monitoring and evaluation tools will be used.	PI PS	E
1.3.2, 1.5.1, 1.5.2, 1.5.5	1.1.3.2.2	1	Determine controls necessary to decrease the probability of occurrence for accidents with unacceptable consequences to a tolerable level (ALARA). Controls are determined for anticipated operational states. [1.1.3.a, 1.1.3.b, 1.1.3.f]	PE PS	E
1.5.1, 1.5.2	5.2.2.4.1	1	Enter documentation into the cylinder management document center regarding corrosion mechanisms and technologies assessed	PE	E

			SEMP "E" Needed Actions to EDP WBS Element		
WBS #	**SEMP #**	**Pri.**	**Action**	**Resp. Org.**	**(E)DP or (P)MP**
1.3.2, 1.5.5	2.2.1.2.5	1	Identify operational control(s) for each function that are needed to prevent, reduce, and mitigate cylinder damage during test/demonstration, start-up, routine, emergency, off-normal, and standby states of operation.	PS	E
1.1, 1.3.2, 1.4.1, 1.4.2	4.1.2.2.3	2	Identify factors that make cylinders non-conforming and identify constraints necessary to maintain compliance with the safety envelope (non-conformance may be based on non-certified volumes, exceedence of fill limits, etc.) [4.1.2.a]	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.1.5.2.3	2	Determine inspection/acceptance requirements for transitioning from one function to another if one valve and plug baseline configuration is not implemented. [2.1.5.a, 2.1.5.b]	PE PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.2.1	2	Develop code case(s) to demonstrate compliance with industry standards. [4.1.2.b, 4.1.2.c]	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.4	2	Establish inspection/evaluation methods for determining the acceptability of cylinders relative functional criteria. [4.1.2.d]	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.4.1	2	Determine a technically acceptable risk-based periodicity to perform inspections and evaluations for determining the acceptability of cylinders' relative functional criteria. [4.1.2.e]	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.4.4	2	Define ultrasonic thickness techniques and their application i.e., how many points, and extent of area to measure thickness to verify compliance with functional criteria.	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	4.1.2.2.4.7	2	Perform laboratory studies to support the cylinder functional acceptance criteria and the cylinder monitoring evaluation techniques.	PS	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2, 1.5.1	2.1.5.2.1	2	Identify performance objectives for cylinder valve and plugs for each system function under the anticipated operational states. Define performance in terms of industry standards to the extent possible.	PE PS	E
1.1.1, 1.1.2, 1.1.4, 1.3.2	2.1.4.2.4	2	Identify and evaluate modifications to the cylinder storage array to meet system performance objectives.	PS	E
1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.2.1, 1.3.2	2.2.1.1	2	Analyze options that would prevent cylinder damage (including new or modified equipment) during handling, processing, and transporting operations.	PS	E
1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.2.1, 1.3.2	2.2.1.2.3	2	Identify performance objectives for cylinders, support structures, and storage facilities relative to handling, processing, and transporting methods and equipment. [2.2.1.f]	PE	E
1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.2.1.2.4	2	Identify engineered control(s) for each function that are needed to prevent, reduce, and mitigate cylinder and coating damage.	PS	E
1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.2.1.2.5.1	2	Define methods for handling, processing and transporting cylinders and corroded cylinders to meet system performance objectives. [2.2.1.a, 2.2.1.g]	PE PS	E
1.1.1, 1.1.4, 1.3.2	1.1.1.2.2.2	2	Integrate the functional flow of cylinder inspections, degradation studies, degradation factor monitoring, and cylinder maintenance.	PS	E
1.1.1, 1.3.2	2.2.1.2.4.3	2	Evaluate engineered controls to mitigate damage to cylinders and coatings from the use of existing equipment. [2.2.1.e]	PS	E
1.1.2, 1.1.4, 1.3.2	2.1.3.2.4	2	Determine inspection and maintenance methods to maintain compliance with this requirement.	PE PS	E
1.1.2, 1.1.4.4, 1.2.1, 1.2.2, 1.3.2	2.1.3.2.1	2	Define performance objectives of cylinder support structures with respect to system functions including the interface with cylinder coatings, periodic inspections, and water drainage. [2.1.3.a, 2.1.3.b]	PS	E

			SEMP "E" Needed Actions to EDP WBS Element		
WBS #	**SEMP #**	**Pri.**	**Action**	**Resp. Org.**	**(E)DP or (P)MP**
1.1.2, 1.1.4.4, 1.2.1, 1.2.2, 1.3.2	2.1.3.2.3	2	Identify and evaluate modifications to cylinder support structures to meet cylinder time of wetness performance objectives.	PS	E
1.1.2, 1.1.4.4, 1.2.1, 1.2.2, 1.3.2	2.1.3.2.3.1	2	Assess current designs to determine their capacity to drain water.	PS	E
1.1.4, 1.2.2, 1.3.2	2.1.4.2.3	2	Identify and evaluate modifications to existing storage facilities and new storage facility designs so that performance objectives are met.	PS	E
1.1.4, 1.3.2	2.3.3.1	2	Analyze alternatives to repairing/replacing breached, thinned, and other expected non-conforming cylinder conditions?	PS	E
1.1.4, 1.3.2, 1.5.1, 1.5.2	2.1.2.2.1	2	Define acceptable cylinder time of wetness in a manner such that it is technically meaningful and can be verified.	PS	E
1.1.4.2, 1.3.2	2.1.1.2.1	2	Define performance objectives for coating (toughness, adhesion, porosity, repairability, life expectancy). [2.1.1.a, 2.1.1.c]	PS	E
1.1.4.2, 1.3.2	2.1.1.2.2	2	Select coating.	PS	E
1.1.4.4, 1.2.2, 1.3.2, 1.4.1	2.1.4.2.3.1	2	Assess current storage facilities for deficiencies in meeting performance objectives.	PE PS	E
1.2.1, 1.2.2, 1.3.2	2.2.1.2.4.2	2	Incorporate into new handling equipment design additional engineered controls to prevent coating damage from the equipment and damage when placing cylinder on support structures. [2.2.1.d]	PS	E
1.3.2, 1.4.1, 1.4.2	5.2.2.1	2	Trade study alternatives/options of life-cycle projections.	PE PS	E
1.3.2, 1.5.1	2.1.5.2.2	2	Integrate these performance objectives with the required configuration of the valve and plug. (packing, port and packing nut condition, valve body, threads showing, stem seat, torque, thread to boss interface including the presence of tape).	PE PS	E
1.4.1, 1.4.2	5.2.2.3.3	2	Identify the interfaces within the system configuration.	PE PI	E
1.1.1, 1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	1.1.1.2.2.1	3	Integrate the purpose of cylinder inspection functions including code inspections, periodic visual inspections, handling, transport, maintenance, and contents transfer functional acceptance inspections.	PS	E
1.1.1, 1.1.3, 1.1.4, 1.1.5, 1.3.2, 1.5.2	2.2.1.2.2	3	Identify methods and equipment to be used to handle, process, and transport cylinders and their contents.	PE	E
1.1.1, 1.1.4, 1.3.2	2.3.2.1	3	Analyze option to automate operations involving deteriorated cylinders.	PS	E
1.1.2, 1.1.3, 1.1.4, 1.1.5, 1.3.2	2.1.2.2.2.2	3	Integrate the structural feature performance for the surveillance and maintenance function with performance objectives for the other system functions.	PI	E
1.1.2, 1.1.4, 1.3.2	2.1.2.2.2.1	3	Define performance objectives of the cylinder structural features relative to the surveillance and maintenance function.	PS	E
1.1.2, 1.3.2, 1.4.1, 1.4.2	4.2.2.2.3	3	Identify which collected data will be used in the forecasting. Integrate forecasting with monitoring efforts. [4.2.2.a]	PI PS	E
1.1.2, 1.4.1, 1.3.2, 1.4.2	4.1.1.2.4	3	Determine a method to verify that all potential pathways of exposure to the environment are being monitored.	PE PS	E
1.1.4, 1.1.5, 1.3.2	2.1.4.2.1	3	Define, using technical basis, storage facility performance objectives including retention of moisture, operational use, and expected life. [2.1.4.a, 2.1.4.b]	PS	E
1.1.4, 1.3.2	2.1.2.2.2	3	Identify all cylinder structural features that retain water beyond acceptable time of wetness.	PS	E

			SEMP "E" Needed Actions to EDP WBS Element		
WBS #	**SEMP #**	**Pri.**	**Action**	**Resp. Org.**	**(E)DP or (P)MP**
1.1.4.2, 1.2.1, 1.2.2, 1.3.2	2.2.1.2.4.1	3	Integrate the protection of cylinder coatings into the saddle design. [2.2.1.f]	PS	E
1.1.4.2, 1.3.1, 1.3.2	2.1.1.2.3	3	Develop coating method including surface preparation, coating application, and curing.	PS	E
1.1.4.2, 1.3.2, 1.4.1, 1.4.2	2.1.1.2.4	3	Establish a coating work plan and schedule that prioritizes cylinders on the basis of condition.	PI	E
1.2.1, 1.2.2, 1.3.2	2.1.3.1	3	Analyze cylinder support structure options to minimize cylinder time of wetness and accomplish other system performance objectives.	PS	E
1.3.2, 1.4.1, 1.4.2	4.1.3.1	3	Analyze optional storage configuration to reduce or eliminate degradation factors.	PS1	E
1.3.2, 1.4.1, 1.4.2	4.2.1.2.2	3	Define and describe categories in terms of cylinder functional criteria and/or factors that could adversely impact cylinder integrity.	PS	E
1.3.2, 1.4.1, 1.4.2	4.2.2.2.2	3	Identify which cylinder condition elements are to be forecasted. Elements are to be selected based on intended future use of the cylinders. [4.2.2.a]	PE PS	E
1.3.2, 1.4.1, 1.4.2	4.2.2.2.4	3	Define procedures for forecasting cylinder condition. Using these procedures will identify specific cylinders in need of specific surveillance and maintenance.	PI PS	E
1.3.2, 1.4.1, 1.4.2	4.2.2.2.6	3	Establish a process to periodically review forecasting results with the performance objectives through the use of performance indicators. [4.2.2.b]	PE PI PS	E
1.3.2, 1.5.1, 1.5.2, 1.5.3	4.1.3.2.4	3	Develop a monitoring plan, incorporating the methods and frequencies for performing those methods.	PE PI	E
1.3.2, 1.5.1, 1.5.2, 1.5.5	1.1.3.2.1.1	3	Identify plausible accident scenarios given identified functional hazards. Plausible accident scenarios to be identified will include scenarios stemming from cylinder breaches (continued below)	PE PS	E
1.3.2, 1.5.1, 1.5.2, 1.5.5	1.1.3.2.1.1 (continued)	3	into the ullage space and degraded cylinder conditions as possible initiators. [1.1.3.b]	PE PS	E
1.3.2, 1.5.3	4.1.3.2.2	3	Develop a database for tracking degradation factor monitoring data.	PS	E
1.3.2, 1.5.5	1.1.2.2.1	3	Identify the industrial, chemical, and radiological hazards within the program configuration (see requirement 1.1.1). [1.1.2.a]	PS	E
1.3.2, 1.5.5	1.1.2.2.2	3	Perform process hazards analysis (see requirement 1.1.1). [1.1.2.a]	PS	E
1.3.2, 1.5.5	1.1.2.2.3	3	Grade hazards to identify program emphasis areas for detailed analysis and development of controls. [1.1.2.a]	PS	E
1.3.2, 1.5.5	1.1.2.2.3.1	3	Record the hazard analyses in the safety envelope documentation. [1.1.2.a]	PS	E
1.3.2, 1.5.5	1.1.3.2.1.2	3	Determine the probability of accidents scenarios occurring. [1.1.3.b]	PS	E
1.3.2, 1.5.5	1.1.3.2.3	3	Complete the risk analysis and risk control sections of the SAR relative to the program. [1.1.3.b]	PE PS	E
1.4.1, 1.4.2, 1.5.1, 1.5.2	1.1.1.2.2	3	Identify and document all functions, subfunctions, and interfaces needed to meet objectives. (Develop functional flow diagrams and interface diagrams.) [1.1.1.a]	PS	E
1.3.2	1.1.1.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	1.1.2.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	1.2.2.1		An analysis of optional methods is not applicable.	PE PS	E

			SEMP "E" Needed Actions to EDP WBS Element		
WBS #	**SEMP #**	**Pri.**	**Action**	**Resp. Org.**	**(E)DP or (P)MP**
1.3.2	2.1.1.1		An analysis of optional methods for meeting this requirement is not applicable.	PE PS	E
1.3.2	2.1.4.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	2.1.5.1		An analysis of optional methods for meeting this requirement is not applicable.	PE PS	E
1.3.2	2.2.2.1		Analysis of optional methods for meeting this requirement is not applicable.	PE PS	E
1.3.2	2.3.1.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	3.3.1.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	4.1.1.1		An analysis of optional methods for meeting this requirement is not applicable.	PE PS	E
1.3.2	4.2.1.1		An analysis of optional methods to meet this requirement is not applicable	PE PS	E
1.3.2	4.2.2.1		An analysis of optional methods to meet the requirement is not applicable.	PE PS	E
1.3.2	5.1.1.1		An analysis of optional methods to meet the requirement is not applicable.	PE PS	E
1.3.2	5.2.1.1		An analysis of optional methods to meet the requirement is not applicable.	PE PS	E